The Circulatory System – Chpt. 19 & 20 Study Guide

- Only larger animals with more complex tissues/organs have need of a circulatory system
- Small animals with simplistic body plans depend on diffusion instead

Functions
1) Transport of:
   a) nutrients
   b) gases
   c) hormones
   d) antibodies

2) Temperature Regulation – distributes & regulates heat throughout the body

Human Circulatory System:
→ 3 components:
   1. Blood
   2. Heart
   3. Blood Vessels

Blood – Chapter 19
Blood contains the following components:
1. Red Blood Cells (RBCs or erythrocytes) – cells that carry oxygen
2. White Blood Cells (granular & agranular) – disease fighting cells
3. Platelets – small cell fragments that help in forming blood clots
4. Plasma – clear, yellowish liquid matrix of blood
Blood Clotting

Extrinsic Pathway
- Damage to tissue outside the vessel
  - Tissue Thromboplastin
- Activated Factor X
- Prothrombin → Thrombin
  - Fibrinogen → Fibrin
    - Factor XIII → Blood Clot

Intrinsic Pathway
- Damage to the blood vessel
  - Cascade of clotting factors
    - Inactive Factor X
      - Activated Factor X
        - Prothrombin → Thrombin
Blood Types
-Glycoprotein markers (antigens) on the surface of red blood cells help to determine compatible matches when blood is donated or received during transfusion.

ABO system
Type A – has “A” glycoprotein (antigen) on RBCs
Type B – has “B” glycoprotein (antigen) on RBCs
Type AB – has both “A” and “B” glycoproteins (antigens) on RBCs
Type O – has neither “A” nor “B” glycoprotein (antigen) on RBCs

Rh factor
Another marker (sometimes called the “D antigen”) on surface of RBCs → “+” means Rh factor is present, “-” means it is absent

Human Heart – Chapter 20
- 4 chambers:
  - right atrium & right ventricle → oxygen-poor blood enters and leaves this side of heart
  - left atrium & left ventricle → oxygen-rich blood enters and leaves this side of heart
- Valves prevent backflow of blood in heart; atrioventricular (AV) valves with will be either bicuspid (dual-flap; also called mitral valve – separates left atrium & ventricle) or tricuspid (triple-flap; separates right atrium & ventricle)
bicuspide \rightarrow \bigcirc \quad \text{tricuspid} \rightarrow \bigcirc

Semilunar valves separate ventricles from vessels out of which blood exits the heart – both are triple-flapped (on right side of heart, pulmonary valve separates right ventricle from pulmonary trunk; on left side of heart, aortic valve separates left ventricle from aorta)

Pathway of blood flow through the system’s circuits:

Cardiac Electrogenic Conduction System
- **Sinoatrial (SA) Node** (located in upper right atrium) is the pacemaker of the heart → has muscle cells that are self-excitable and set the pace for contraction of the cardiac muscle

- **Atrioventricular (AV) Node** (located in lower right atrium) is stimulated by SA Node and then sends an impulse resulting in the contraction of the ventricles.

- **AV Bundle** - Bundle Branches - Perkinje Fibers

Cardiac Cycle
The part of the heart cycle in which contraction occurs is known as **systole**, and the portion in which relaxation occurs is known as **diastole**.

Blood pressure = systolic pressure over diastolic pressure

Cardiac Output
C.O. = Heart Rate \times \text{Stroke Volume} \rightarrow \text{C.O.} = \text{H.R.} \times \text{S.V.}
H.R. = beats per minute; S.V. = end diastolic volume in ventricles – end systolic volume in ventricles (S.V. is the volume of blood pumped from the heart per beat)
Electrocardiogram (ECG)

- **P-Wave**: Depolarization of atria in response to SA node triggering.
- **T-Wave**: Ventricular repolarization.
- **PR Interval**: Delay of AV node to allow filling of ventricles.
- **QRS Complex**: Depolarization of ventricles, triggers main pumping contractions.
- **ST Segment**: Beginning of ventricle repolarization, should be flat.

**Diagram**: Graph showing the different components of an ECG trace.

**Table**: Stages of cardiac cycle:

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<thead>
<tr>
<th>Atrial diastole</th>
<th>Atrial systole</th>
<th>Atrial diastole</th>
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<tbody>
<tr>
<td>Ventricular diastole</td>
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**One cardiac cycle**